# Introduction of the knowledge intensive system Lay-Monitor

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**In the Dutch laying sector several developments can be observed of which two will be highlighted. The first one is the rapid development in information and communication technology. Nowadays, on most professional poultry farms process computers control the feeding of the hens and the climate of the house. Process computers can measure also the water intake, body weight, flock uniformity and in some cases the number of eggs. Together with the registration of the egg weight, the egg quality and the mortality a lot of production parameters are measured. The number of gathered data increases substantially if the poultry farmers collect the data per flock, per compartment, per battery, per battery row or eventually per cage. If data are collected daily, which is a prerequisite to manage the production process, the poultry farmer is confronted with a lot of data that should be transformed to relevant information.**

A second development is the increased attention for the health status of the Dutch poultry sector (DiB, 1995). The ministry of Agriculture, Nature Management and Fisheries (LNV), the Animal Health Service (GD), the Product Boards for Livestock, Meat and Eggs (PVE), and the Dutch Board of Agriculture (LBS) have taken the initiative to improve the health status. The special platform 'Animal health on the move' (DiB) has been introduced 1) to stimulate projects and ideas that improve the health status, 2) to structure the projects and the organisations that are concerned with the health of the poultry sector, 3) to monitor the health status of the sector, and 4) to reach consensus concerning poultry health problems. The main objectives of DiB are to become a leading nation within the EU with respect to poultry health and to improve within five years the health status, the production processes and the product quality. There is a strong relationship between the health status and management. Therefore, a strategic approach of continuous improvements is needed. So called 'health planners' will be used as the instruments.

These two general developments, together with an analysis of the goals, critical success factors, information needs, and management concepts of aviary farmers (Lokhorst et al, 1996) resulted in the development of the prototype of a specific management support system. This support system, with the name Lay-Monitor, has been developed at the DLO Institute for Agricultural and Environmental Engineering (IMAG-DLO). This paper gives a short description of the prototype and an insight in the efforts that have been put into the introduction of this knowledge intensive system.

## Theoretical background

### Management cycle

The continuous improvement of the health status of flocks and the management of farms are based on the traditional cycle of planning and control. Within this cycle, which is shown in figure 1, two different cycles are distinguished. The control cycle is used to monitor the production process and to detect abnormal production circumstances. Based on registered data, calculated key figures and comparison with a standard it is determined whether the status of the production process is normal or abnormal. This is done with routinely collected data. If the status is abnormal the problem cycle is activated. Sometimes extra tests and information is needed to determine the exact problem, then alternative solutions must be looked at, and some actions must be taken to solve the problem. With this theory it is possible to monitor the production process, to detect abnormal situations, and to solve the problem by choosing the right corrective actions.

### Innovation chain

Theoretically the introduction of innovative knowledge based systems consists of three main phases (Hilhorst, 1992). The first is the research phase, and it is characterised by knowledge discovery, knowledge development and the modelling of the knowledge. A typical product of this phase is a prototype of a knowledge intensive system. In the deve-

lopment phase, the second phase, the knowledge is tested for her added value in practical farm situations. A field test is part of this phase. The development phase results in an integrated system that easily can be maintained. Integrated means in this situation that it is closely connected to other software products that already are used on practical farms, e.g. a management system. In the third phase, the **market development** phase, the marketing strategy and the marketing organisation must be set up. The result will be an applicable and sellable product.

## Lay-Monitor, the knowledge intensive system

Lay-Monitor is a prototype of a knowledge intensive system that has been made to support aviary farmers in the daily evaluation of the critical success factors: control of feed consumption, control of the climate and the early detection of diseases. Data are gathered in the poultry house, stored in the commercial available management information system SIVA-PLUIMVEE, and exported to Lay-Monitor. Data can be presented graphically. New variables can be added easily by using a built-in calculator. Two main parts of Lay-Monitor are the expert system (Lokhorst and Lamaker, 1996) and the simulation model (Lokhorst, 1996a). The expert system compares daily quantitative data on feed consumption, water consumption, ambient house temperature, hen day egg production, egg weight, cumulative mortality, hen weight, flock uniformity, second grade eggs and floor eggs with the appropriate reference values. The poultry farmer can use different types of reference values. The differences between the actual values and the reference values are classified, combined and compared with known aberrations. With the aid of experts the following aberrations are distinguished: respiratory disorder, osteomalacia, digestive disorder, fast mortality, ecto-parasites, extreme hot or cold day, major feed or water restriction, change in feed composition and disturbances in feed and water dispensing installations. The expert system focuses on the control cycle, but also a small part of the problem cycle has been implemented. In order to be able to really diagnose problems qualitative information has been used. The simulation model consists of several mathematical curves that describe the production process. The parameters can be adjusted easily. The non-linear fitting procedure of SPSS, a commercial available statistical package, was used to fit the parameters. The simulation model is used to produce flock specific reference values for the expert system and to determine the economic consequences of aberrations (Lokhorst, 1996b). The prototype of Lay-Monitor is the result of the research phase. Some preliminary validation has been done, but a logical next step will be a field test.

## Health planner

Stimulated by DiB, the Agricultural Telematics Centre (ATC), the Poultry Research Station (PP), the Animal Health Service (GD) and the Dutch Agriculture Advisory Service (DLV) formulated a project to develop a health planner for the poultry sector. Later on the DLO Institute for Agricultural and Environmental Engineering joined the project team. The health planner was intended for all poultry farmers, so a computerised and a paper version should be made. The aim of the health planner was to develop a tool to prevent and to control production and health aberrations. The health planner aimed therefore to support the control cycle as well as the problem cycle. The health planner should result in a farm specific tool that uses specific control points to detect aberrations better and earlier. In the ideal situation it

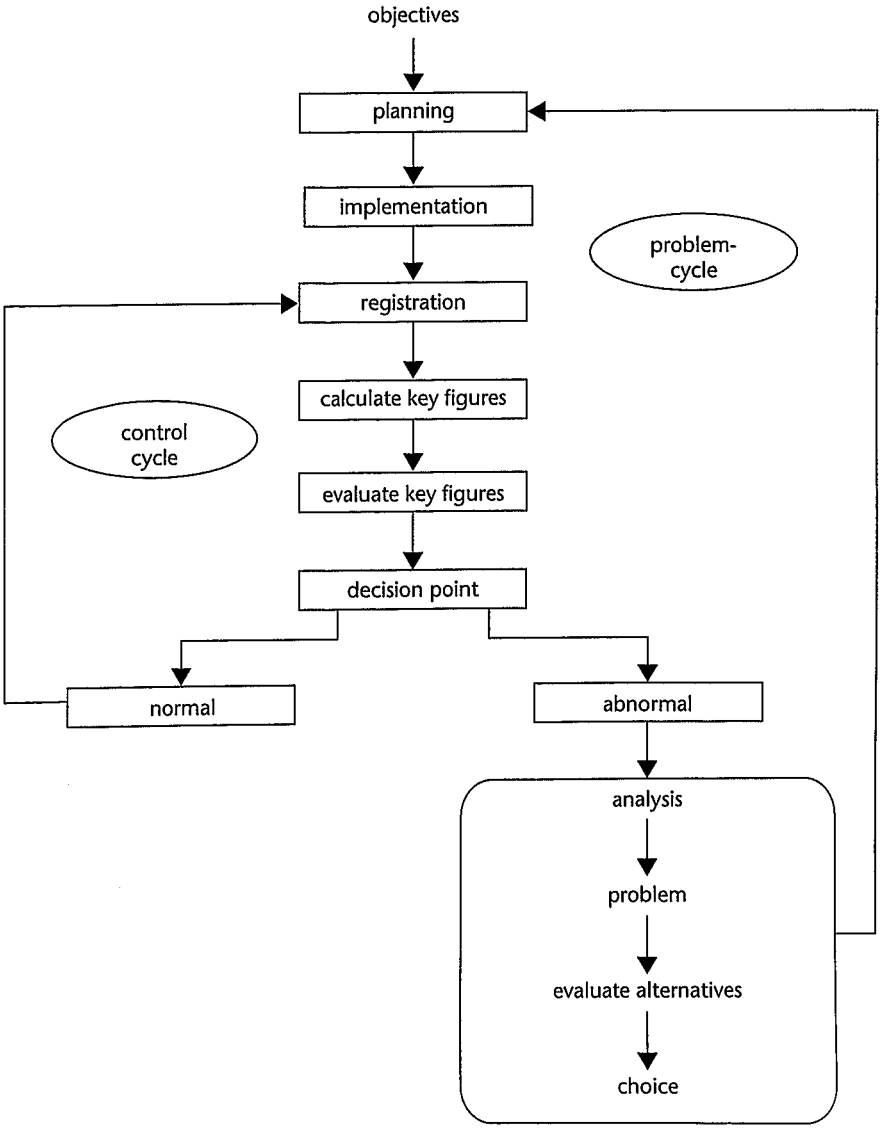


*Figure 1 – Management cycle for continuous improvement of the production process.*

should also advise in preventing aberrations. The health planner should be based on existing knowledge, it must be practicable, tested and robust, for all poultry types, and it should function with a minimum of extra data collection. The health planner is still in its planning phase.

## Experiences with introduction

Research resulted in the prototype Lay-Monitor. Much effort has been put in the formulation of the project to develop a health planner. It was intended to use the experience gathered with the development of Lay-Monitor. Additional discussions took place with poultry farmers, veterinarians, advisors, and representatives of different organisations. The general conclusion of the discussions was that the principle used in Lay-Monitor suits to the experience of poultry farmers and commercial organisations, that it can help to improve the health care situation in the Netherlands, and that it can be used to tackle the problem of the growing data. It was also concluded that the main initiative for further developments should come from industrial partners. Consequently effort has been put into bringing together industrial partners, and to convince them of the potentials of Lay-Monitor. A special workshop has been organised to inform several industrial partners. The main problem in this phase is that the potential partners are all relatively small and that they cannot take much risk. Five organisations were willing to cooperate in further actions to bring the knowledge intensive system closer to the potential end users. This resulted in the proposal to test the present version of Lay-Monitor on 6 poultry farms. The knowledge in the present version of Lay-Monitor will be updated for cage systems, because they are still seen as the most efficient housing system. The test will be limited to the laying sector and to the testing of the control cycle. The project will be partly financed by DiB. A good mix of different organisations is represented in the project team. Farmtec as manufacturer of feeding systems and sensors, Hotraco as manufacturer of process computers, Siva software as manufacturer of management information systems, UTD as food deliverer and advisor, Pluimveepraktijk Zuid Nederland as veterinarians and the ATC and IMAG-DLO as project co-ordinators and researchers. The field test has been started in January 1998 and will end in September 1999. After this test it must be possible for the commercial organisations to decide whether they will go into the development and the market development phases of Lay-Monitor.

A second result of the workshop was that IMAG-DLO has been invited to join an international group of organisations that has proposed an EU project in the CRAFT round. The acronym of the project is EGGQuality. The project concerns the improvement of egg packing machines for egg packing stations. Besides improvements of the egg packer, work will be done on printing technologies and on the feedback of egg quality data to egg producers. For this last task the knowledge intensive system Lay-Monitor will be used. Detailed egg quality information will be sent back to the egg producer where it is used in monitoring the production process and to find aberrant production circumstances in an early stage. This research project fits very well in the upcoming interest in chain management systems. The following Dutch companies are involved in this international project: Moba-Staalkat, Weko Food International, IMAG-DLO, Q-Ray Agrimathica, and Globus Ei. Other partners come from Sweden, Spain, Northern Ireland, United Kingdom, Denmark and Germany.

A general conclusion from the experiences so far is that sole scientific research is no guarantee for a successful introduction. Ideas and prototypes have to be discussed with potential partners. In most cases they do not read scientific journals, so the subject has to be brought under their attention. Organising the workshop was crucial for a successful follow up. The present version of Lay-Monitor is still in the transition from the research phase to the development phase, but there are some interesting new projects that will help to bring the interesting developments in the world of 'knowledge intensive systems' closer to the potential end users.

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